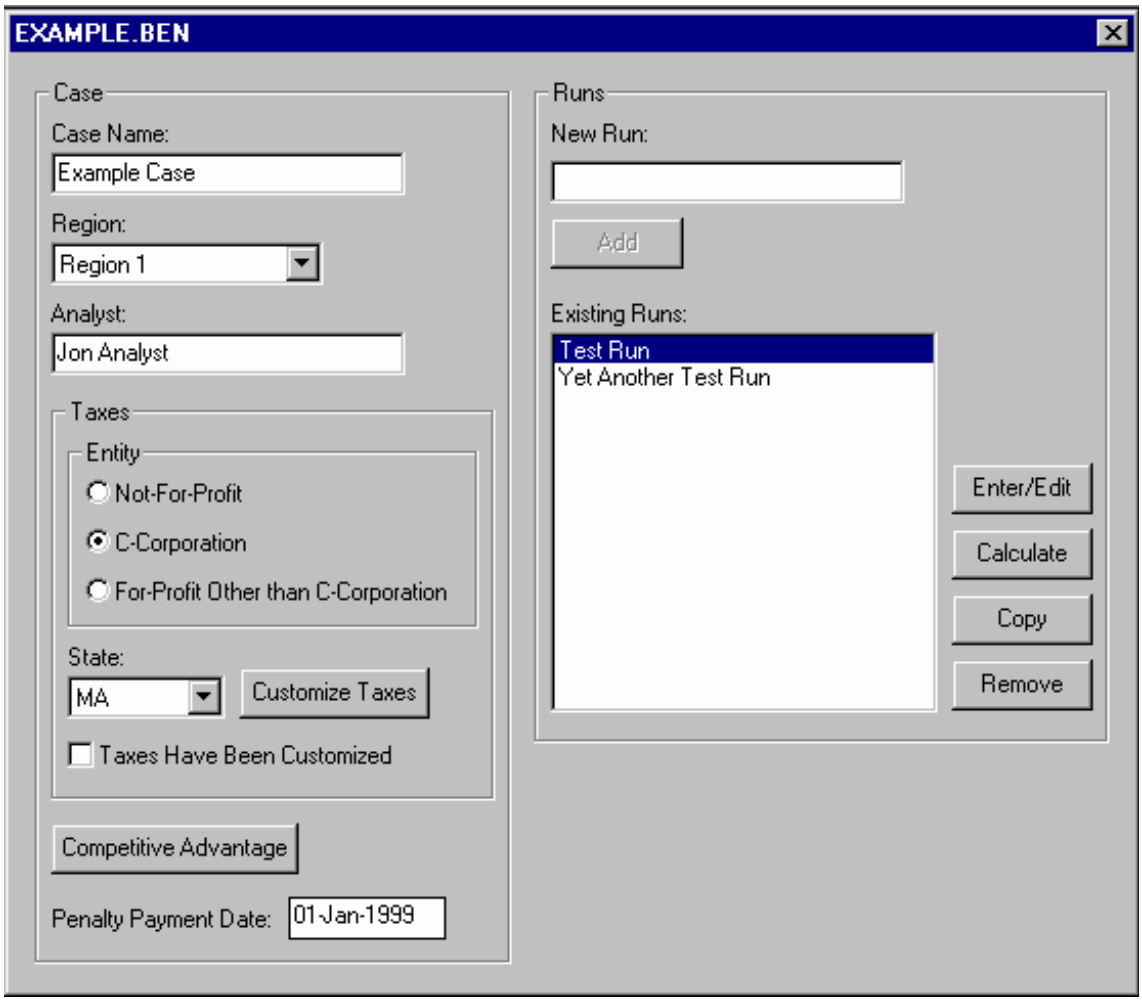
To run BEN, you enter certain data, including the entity's tax status and state; the dates for penalty payment, noncompliance, and compliance; and the compliance cost estimates and estimate dates. BEN provides standard values — which you can modify — for tax, inflation, and discount rates, as well as the capital equipment's number of replacement cycles and useful life, and the one-time nondepreciable expenditure's tax deductibility. This chapter explains these variables (in the order in which you enter them in BEN), covering the criteria for developing input values and the basis for the standard values. Each explanation also states how a change in each variable's value will affect the economic benefit result, as summarized below (holding all other variables constant).

Input Item	Direction of Change	Impact on Economic Benefit
Marginal Tax Rate	increase	decrease
Penalty Payment Date	later	increase
Cost Estimates	increase	increase
Noncompliance Date	later	decrease
Compliance Date	later	increase
Discount/Compound Rate	increase	increase
Number of Replacement Cycles	increase	increase
Useful Life of Capital Equipment	increase	decrease
Projected Rate for Future Inflation	increase	varies
Cost Index for Inflation	PCI to other index	varies
Tax-Deductibility of One-Time, Nondepreciable Expenditure	tax deductible to not tax deductible	increase

A. CASE SCREEN

The case screen shown below is what you see when you first open BEN. This is where you enter the following variables: case name, EPA region, analyst name, entity tax status, state, marginal tax rate, penalty payment date, and run name. It is also where you consider questions of competitive advantage. The right side of the case screen is where you create, edit, calculate and remove runs.



1. Case Name, EPA Region, Analyst Name

Case name, analyst name, and EPA region are the first three inputs in BEN. They are for reference purposes only and do not affect the calculation. Each of them will appear along with the current date on the bottom of every page of the results.

a. Case Name

Case name is the first input in BEN. This name can be any length and can contain letters, spaces, punctuation and numbers (although you may not leave it blank). It will appear along with the current date, analyst name, and EPA region on each page of the results. Since its sole purpose is documentation, this label can contain anything you choose. It can reflect the violator's name or a characteristic of the specific case (e.g., "Payment on July 15, 1999"). Each case can contain several runs, so you will not need to alter the case name to save individual calculations.

b. EPA Region

Like case name, EPA Region is for reference purposes only (although you may not leave it blank). It will appear along with the current date, case name, and analyst name on each page of the results. A pull down menu to the right of the cell lists all ten EPA regions, EPA headquarters, and the option of "other." BEN will not allow you to type in a different entry.

c. Analyst Name

Like case name and EPA region, analyst name is for reference purposes only (although you may not leave it blank). This name can be of any length and can contain letters, spaces, punctuation and numbers. It will appear along with the current date, case name, and EPA region on each page of the results. It can be anything you choose, but it is most appropriate simply to enter your own name.

2. Entity Type, State, Customized Tax Rate

BEN needs to know the violator's tax rate to calculate economic benefits, as compliance costs are usually tax-deductible. Because tax-deductible expenses and depreciation associated with capital investments reduce taxable income they result in tax savings. The higher the tax rate, the higher the tax savings, and therefore the lower the economic benefit of noncompliance. BEN uses the marginal tax rate to account for the tax effects of compliance costs. Changing the violator's state or tax status changes the violator's marginal tax rate and thus alters economic benefit.

a. Entity Type

BEN asks you to designate the tax filing status of the entity. The three options are: Not-For-Profit, C-Corporation, or For-Profit Other than C-Corporation. Choosing the correct tax status is critical, because it determines BEN's application of the tax rate and the discount/compound rate. BEN will default to C-Corporation status.

A C-Corporation files a federal tax Form 1120 or Form 1120-A. These companies are taxed at corporate income tax rates. Virtually all publicly traded companies are C-Corporations, but small privately held firms can also be C-Corporations.

For-profit entities other than C-corporations may be S-corporations, partnerships, or sole proprietorships (e.g., a corner grocery store). These entities file federal tax returns other than 1120 or 1120-A (e.g., an S- corporation files a Form 1120-S and a Schedule K for each shareholder). The income and expenses of these organizations are divided among the shareholders and reported on their individual income tax returns. Income is therefore taxed at the individual income tax rate.

Not-for-profit entities, such as municipalities, public authorities, and charitable organizations, generally have a tax-exempt status. When you indicate that the violator is a not-for-profit entity, BEN sets the marginal income tax rate to zero. (Although rare, certain not-for-profit companies are subject to taxation. You should verify the status of the not-for-profit in question and adjust the tax rates accordingly.)

b. State

This is the state in which the entity conducts the majority of its business, which is not necessarily the state in which it is incorporated. Selecting the correct state is important because BEN uses state-specific tax rates in its calculations. The pull-down menu lists all fifty states plus "AVG" and "BEN." "AVG" is an average of all state tax rates (appropriate if the noncompliant facilities span several states). "BEN" is similar to "AVG", but instead of adjusting the state average each year, it uses one state average for the period 1987-1992 and another for 1993 and beyond. This option is appropriate only for replicating prior calculations from the DOS version of BEN, which used these rates as its standard value.

c. Customized Tax Rate

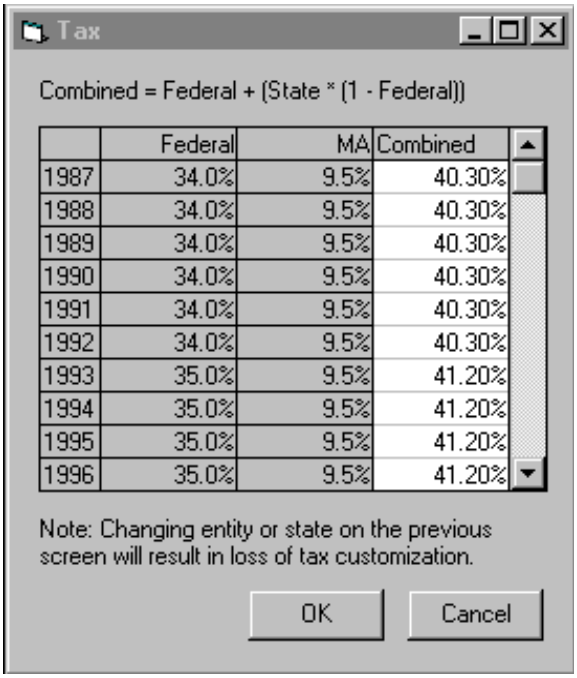
After you have entered the tax status and state of the violator, BEN will automatically calculate the combined marginal income tax rate. The marginal tax rate is the fraction of the last dollar of taxable income that a defendant would pay to federal and state governments. BEN uses the marginal tax rate, not the average tax rate (i.e., total tax divided by total taxable income), because the marginal tax rate is the rate that applies to incremental changes in the violator's tax-deductible expenses.

State tax rates must be adjusted to reflect the fact that you can deduct state taxes from federal taxes. The adjustment is made by multiplying the marginal state tax rate by a factor equal to one minus the marginal federal tax rate, as shown in the following formula:

$$\text{Combined tax rate} = \text{Federal rate} + [\text{State rate} \times (1 - \text{Federal rate})]$$

State income taxes do not include sales tax, inventory tax, charter tax, or taxes on property. One-time tax payments, such as taxes on the purchase of equipment, should be included in the capital investment or in the one-time nondepreciable expenditure. If the tax recurs regularly, then it should be included in the annually recurring cost. For example, sales tax would be included in the capital cost while property tax would be included in the annual cost.

You may have information that supports the use of tax rates other than those supplied by the BEN model (e.g., the entity was not subject to the highest marginal rate). In these situations you can modify the annual rates individually by pressing **[Customize Taxes]**. The tax customization window shown below will appear and you can simply type in your customized values.



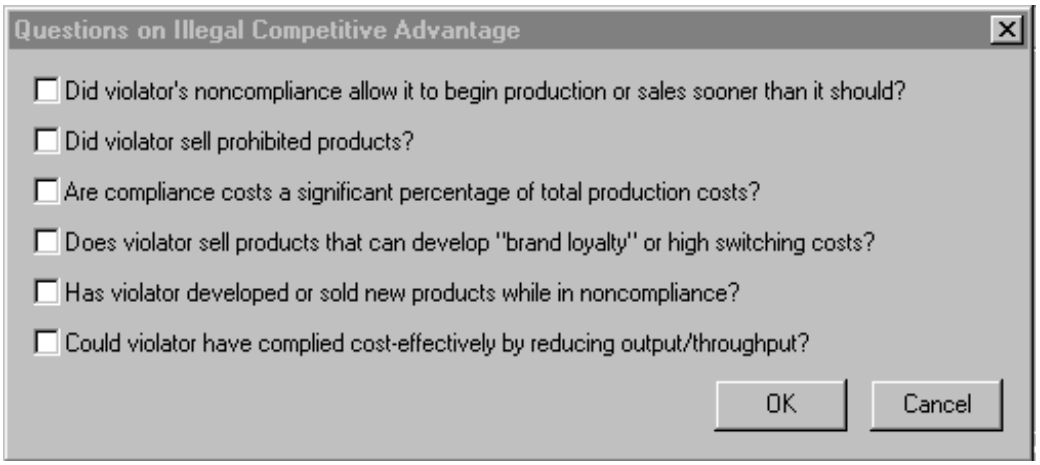
	Federal	MA	Combined
1987	34.0%	9.5%	40.30%
1988	34.0%	9.5%	40.30%
1989	34.0%	9.5%	40.30%
1990	34.0%	9.5%	40.30%
1991	34.0%	9.5%	40.30%
1992	34.0%	9.5%	40.30%
1993	35.0%	9.5%	41.20%
1994	35.0%	9.5%	41.20%
1995	35.0%	9.5%	41.20%
1996	35.0%	9.5%	41.20%

The "Taxes Have Been Customized" box on the case screen will be checked when modifications have been made to the tax rates. Similarly, this information will appear in the BEN run results and print-out. Note that once tax rates are modified, re-designation of the state or entity tax status will result in a loss of the customized information.

3. Competitive Advantage

BEN — or any computer model — is incapable of calculating economic benefit from illegal competitive advantage, leading to a possible underestimate of economic benefit in certain cases. Therefore BEN provides a **[Competitive Advantage]** button and asks questions for case attributes indicative of illegal competitive advantage, providing suggestions for further research and analysis.

You must read the competitive advantage screen and press **[OK]** before BEN will allow you to create a run.



Below are the responses that appear in BEN's results if you check a question box.

1. *Did violator's noncompliance allow it to begin production or sales sooner than it should?*
Violator may have received "early-mover advantage" by beginning production or sales sooner than it should.

2. *Did violator sell prohibited products?*
Violator's net profits from illegally sold products may constitute economic benefit, and if the violator continues to sell similar now-legal products in same market, then lasting market share effect may constitute an additional benefit.

3. *Are compliance costs a significant percentage of total production costs?*
Violator may have benefitted from market share gains by undercutting its competitors through price advantages from noncompliance.

4. *Does violator sell products that can develop "brand loyalty" or high switching costs?*
Violator may have benefitted from market share gains because it sells products that can develop "brand loyalty" or high switching costs.

5. *Has violator developed or sold new products while in noncompliance?*
Violator may have gained "early mover" market share and been able to discourage competitors by keeping prices low, since it developed or sold new products while in noncompliance.

6. *Could violator have complied cost-effectively by reducing output/throughput?* Incremental net profit from higher output/throughput could constitute economic benefit, since violator could have complied cost-effectively by output/throughput reduction.

If you answer affirmatively to any of these questions, further research and analysis is necessary to determine the full extent of the violator's economic benefit. You might wish to consult U.S. EPA's guidance on illegal competitive advantage (available in early 1999), or contact EPA's enforcement economics support helpline, at 888-ECONSPT (326-6778).

4. Penalty Payment Date

The penalty payment date is the date you expect the violator to pay the civil penalty. Dates may be entered as month/day/year (i.e., 7/31/98) or written out (i.e., July 31, 1998). BEN will accept two-digit years, but four-digit years are preferable. You must enter dates to the day.

BEN automatically calculates the final economic benefit as of the penalty payment date and assumes that the violator earns a return on the benefit until that date. Therefore, the benefit figure increases for later penalty payment dates, holding all other variables constant.

A considerable time lag often occurs between when the violator signs the consent decree and when it actually pays the penalty. If the violator is willing to transfer the entire penalty figure to an interest-bearing escrow account on a date before entry of the consent decree, this escrow date may be used as the penalty payment date. Upon entry of the consent decree, the escrowed penalty plus any interest should accrue to the enforcement agency.

You should be certain that the violator knows: (1) the penalty payment date used in your economic benefit calculation; and, (2) that if the penalty payment date is actually later than you have assumed, the economic benefit will be higher. On the other hand, if the violator settles the case and pays its penalty prior to the date you used in your calculation, or if it agrees to escrow the economic benefit amount, the benefit component of the penalty will be lower. By conveying this information early in a negotiation with a violator, you will give the violator added incentive to settle promptly. In addition, this approach will allow you to avoid giving the violator any "unpleasant surprises" should you need to increase the benefit component as a result of a delay in the settlement.

5. Creating/Adding, Copying, and Removing Runs

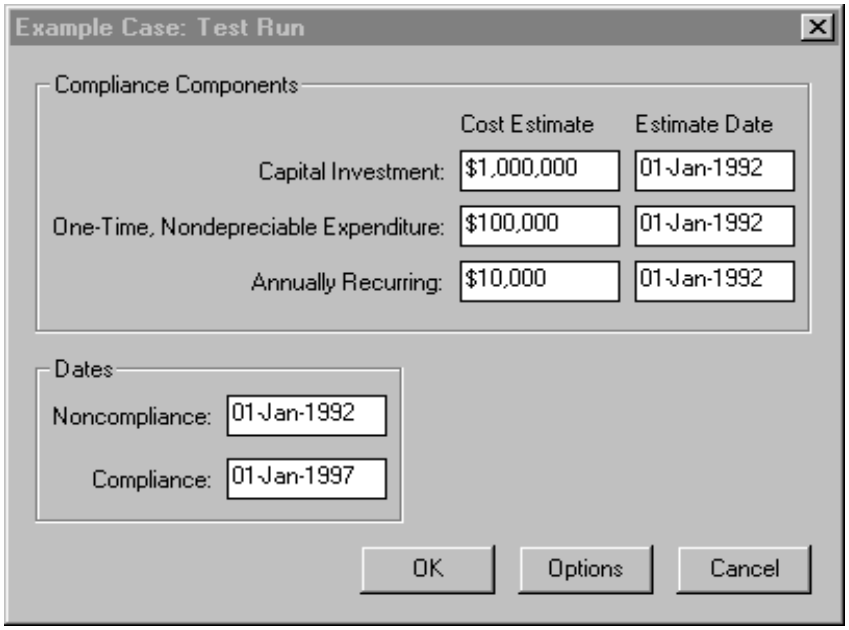
You must create a run before you can enter compliance cost information. To add a new run, enter the run name under "New Run:" and press **[Add]**. BEN will save the new run and list it under "Existing Runs." Run names can be any length and include any letter, punctuation or number. Each case may contain multiple runs.

To copy an existing run select the run you wish to copy from the list of existing runs and press **[Copy]**. A window will appear asking you to enter a name for the new run. No two runs can have the same name. Enter the new name and press **[OK]** to save the new run or **[Cancel]** to delete it. The copy will contain all of the information from the original. Copies are particularly useful when making only minor changes in cost information from run to run, because they can carry over consistent data.

To remove a run select it from the existing run window and press **[Remove]**. A window will appear asking you if you are sure. Press **[Yes]** and the run is deleted. Remember that BEN does not have a "trash bin" to hold deleted runs, so you will have no way to retrieve a run once you have removed it.

B. RUN INPUT SCREEN

To access the run input screen, select a run and press **[Enter/Edit],** or simply double click on the run name. Here you enter cost estimates for three possible compliance components: capital investments, one-time nondepreciable expenditures and annually recurring costs. Each cost component requires a cost estimate and an estimate date. At the bottom of the run screen you must enter the noncompliance and compliance dates.



1. Compliance Cost Components

This is where you enter the costs of the equipment/labor/activities necessary to achieve compliance. Engineers and technical staff in your enforcement program are usually aware of what reasonable costs might be for pollution control technologies and remedial activities, and might also know of standard cost information that exists in publications. Another potential source of information is the violator, who might willingly give you the required data. Otherwise, you can take a number of legal approaches to obtain the data from the violator. The EPA usually has authority to request the necessary information. With a legal issue like this one, the appropriate attorney(s) should also be consulted. In cases where cost data is available, but the required compliance measures are still unclear, two general guidelines will assist you:

(1) The best evidence of what the violator should have done to prevent the violations is what it eventually did (or will do) to achieve compliance. This rule is instructive in those cases where the violator may appear to be installing a more expensive pollution control system than EPA staff believe is necessary to achieve compliance. In such situations, the proper cost inputs in the BEN model are usually still based on the actual (more expensive) system being installed. This is because the EPA should not second guess the business decisions of a violator. A violator often will have sound business reasons to install a more expensive compliance system (e.g., it may be more reliable, easier to maintain, or have a longer useful life).

(2) Costs not truly associated with pollution control efforts to remedy the violations alleged in the complaint should be excluded from BEN inputs, but the violator must present convincing evidence that the costs were not associated with the operation of the pollution control system. For example, if the violator is adding additional capacity to handle a waste stream from a new production line, the incremental costs associated with treating the new waste stream should not be included in the BEN run (based on the assumption that the additional capacity for treatment of wastes from new production was not needed to achieve compliance under previous levels of production). Similarly, if the violator is adding capacity to accommodate normal anticipated business growth, and on-time compliance would not have entailed such additional capacity, then you should exclude the incremental costs of the additional capacity.

You may enter compliance costs with or without commas or dollar signs. BEN will accept decimals but will round the amount to the nearest whole dollar. Enter a zero for any component category where expenses would not be incurred. All else being equal, larger compliance costs will result in a higher economic benefit of noncompliance.

a. Capital Investment

The capital investment cost estimate should include all depreciable investment outlays necessary to achieve compliance. Generally these are expenditures the violator delayed making (although they could sometimes be avoided altogether). Enter a zero if no capital investment was

required for compliance. Holding all other inputs constant, the economic benefit from delay will be greater for larger capital investment outlays.

Depreciable capital investments are made for things that wear out such as buildings, equipment or other long-lived assets. Note that land is not a depreciable capital investment; land costs should instead be input as a one-time non-depreciable expenditure. Typical environmental capital investments include groundwater monitoring wells, stack scrubbers, and wastewater treatment systems. In estimating capital cost, keep in mind this includes all costs associated with designing, installing, shipping, and purchasing the necessary equipment (including sales tax) and associated facilities.

If capital costs involved are avoided (i.e., the violator is not just delaying making the investment, but will never make the investment), after entering all the required information on the run inputs screen, you should set the capital investment delay costs on the specific cost estimates screen to zero.

If you have capital investment costs with significantly different cost estimate dates, you should perform separate runs for each, which you can add together to produce a total economic benefit result.

b. One-Time, Nondepreciable Expenditure

This category includes compliance expenditures that need to be made only once and are non-depreciable (i.e., do not wear out). Enter a zero if no one-time nondepreciable expenditure was required for compliance. Holding all other inputs constant, the economic benefit from delay will be greater for larger one-time nondepreciable expenditures.

Such an expenditure could be purchasing land, setting up a record-keeping system, removing illegal discharges of dredged and fill material, disposing of soil from a hazardous-waste site, or initial training of employees. However, if training or record keeping must occur over time and regularly, these costs should be entered as annually recurring costs. If the one-time nondepreciable expenditure involved is avoided (i.e., the violator is not just delaying making the expenditure, but will never make the expenditure), you should set the one-time nondepreciable expenditure delay costs on the specific cost estimates screen to zero after entering all the required information on the run inputs screen.

Most one-time nondepreciable expenditures are tax-deductible; with the primary exception being purchases of land. Land is an asset and, therefore, cannot be deducted as an expense from taxable income. BEN assumes that the expenditure is tax-deductible unless otherwise specified. To change this assumption uncheck the “Tax Deductible” box on the options screen.

c. Annually Recurring Costs

Annually recurring costs are costs associated with operating and maintaining pollution control equipment. Enter a zero if no (additional) annual costs were required to operate the necessary pollution control equipment. Holding all other inputs constant, the economic benefit from delay will be greater for larger annually recurring costs.

This cost estimate should reflect the average annual incremental cost of operating and/or maintaining the required environmental control measures. These expenditures should include any changes in the cost of labor, power, water, raw materials and supplies, recurring training of employees, and any change in annual property taxes associated with operating the new or improved pollution control equipment. Note that annually recurring costs may be negative if compliance increases efficiency. Include any lease payments for equipment, but not expenses such as annualized capital recovery, interest payments, or depreciation.

Any operating and maintenance (O&M) offsetting credits should also be considered in determining the incremental annual costs. Such credits might represent actual O&M cost savings: heat recovery, product or byproduct recovery, and so forth. To be included, such savings must be proven by the violator, not just asserted. For example, the installation of new pollution control equipment may reduce certain costs (such as sludge disposal) associated with operations during the noncompliance period. If the resulting incremental O&M cost is negative, the net cost savings may be used in determining annual costs. Credit is given only for annually recurring cost savings that are both documented and directly related to compliance.

Annual costs must be equal for each year of the violation, differing only by inflation, to enter them into BEN. If they vary only slightly, you can enter an average estimate of the different yearly figures. If they vary significantly, then you can create separate runs corresponding to the different years of the violation. Each run's noncompliance and compliance dates should reflect the beginning and ending dates for the year of the specific annual cost.

If the annual costs are delayed, and not avoided, then enter them as one-time nondepreciable expenditures. You can either enter the entire sum of the annual costs that have been delayed over the entire noncompliance period, or you can create a separate run for each year of delayed costs. Either way, the noncompliance date should be the midpoint of when the annual costs should have been incurred (i.e., the midpoint of the entire noncompliance period, or the middle of the year), and the compliance date should be the midpoint of when the costs were or will be incurred.

2. Cost Estimate Dates

Each cost estimate needs a date, reflecting the date on which the estimate is premised. Dates may be entered as month/day/year (i.e., 7/31/98) or written out (i.e., July 31, 1998). BEN will accept two-digit years, but four-digit years are preferable. You must enter dates to the day. If you do not

have date information to the day, use the day that falls in the middle of the time frame you have. For example, if all you know is that the estimate was made in May of 1998, use May 15, 1998 as the estimate date. If all you know is that the estimate was made in 1998, use July 1, 1998 as the estimate date. If you have multiple costs for the same component with different dollar-years, enter them as separate runs, and sum the results.

3. Noncompliance and Compliance Dates

For all dates you can use any format, but be sure to enter the year, month, and day. (If you do not enter a day, BEN will assume the first day of the month.) Also, BEN will not accept any dates before July 1, 1987.

The noncompliance date is generally when the first violation of the environmental requirement occurred. BEN uses this as the proxy for when the violator should have actually incurred the expenditures necessary for compliance. Since compliance expenditures must often occur far in advance of actual legal compliance, it is highly conservative to use the date by when the violator should have completed installation of the necessary pollution control equipment and had such equipment fully operational. The benefit from delayed and/or avoided expenditures generally increases with the length of the delay period. An earlier noncompliance date (holding the compliance date constant) will, in virtually all cases, increase the benefit figure. Hence, if you were to use the actual date when the compliance expenditures would have been incurred — if this information were available — the economic benefit would be substantially higher than how EPA typically calculates it.

The compliance date is when the violator came into compliance with environmental requirements or the date when you expect the violator to achieve compliance. BEN once again uses this as the proxy for when the violator actually did — or will — incur the expenditures necessary for compliance. The date when the equipment was initially installed is not necessarily sufficient: the violator needs to be in compliance (for consistency with the noncompliance date), and have already incurred all of the capital and one-time costs and started to incur the annual costs. (Often a significant amount of time is required to "break-in" the equipment and adjust it; thus the compliance date is when compliance is actually achieved.)

Remember though that BEN is ultimately concerned with financial — not legal — dates: your object should be to "follow the money." (In an extreme example, if a violator were to install the required capital equipment — yet for some reason not operate it — then for the purposes of BEN's calculations of the capital investment economic benefit the violator is in compliance.) Using the legal dates of noncompliance and compliance can be a useful proxy, and will keep the noncompliance time period the correct length, but it will generally underestimate the true economic benefit (since the noncompliance period is being artificially shifted closer to the penalty payment date).

Note that in economic benefit analyses, the compliance date must occur after the noncompliance date. A later compliance date (holding the noncompliance date constant) will, in virtually all cases, increase the economic benefit figure. If you are running BEN to calculate the after-tax net present value of an "early compliance" supplemental environmental project, then enter the date when the violator will comply early as the noncompliance date, and the date when the violator is required to comply as the compliance date.

The dates are a major consideration in the BEN analysis. As the interval of non-compliance increases, the economic benefit generally increases. For each month that the violator delays compliance, it delays capital and one-time costs and avoids operation and maintenance expenses. In practice, the period of violation is sometimes not clear. Proving the entire period of violation might encounter evidentiary problems. It might be helpful to perform several different BEN runs to show the impact of different violation periods on economic benefit.

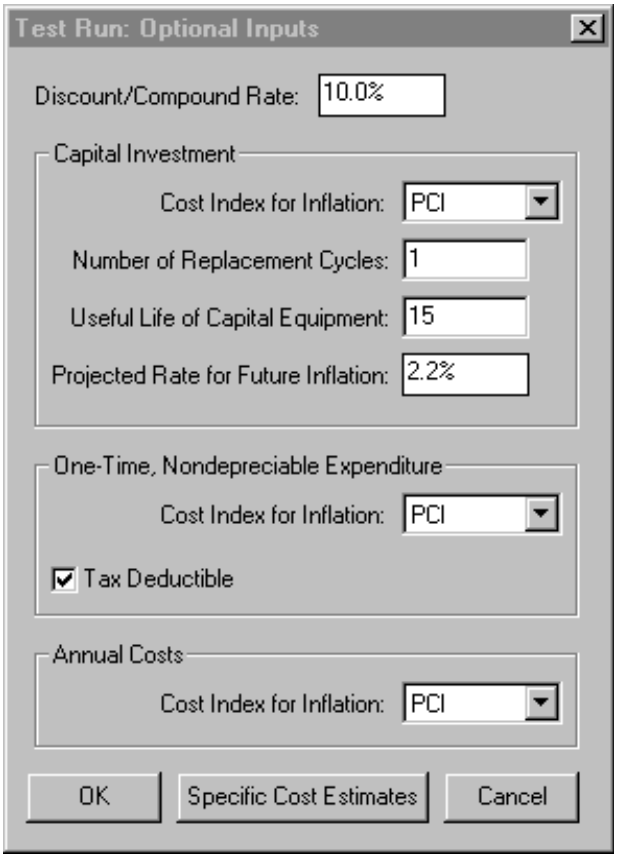
Although a statute of limitations may apply in your case, it should generally affect only the maximum penalty you can assess (i.e., the statutory cap). Since you are only trying to calculate the amount the violator gained by violating the law, you may go beyond any statute of limitations, as long as you do not exceed the statutory cap. Should your case go to trial or hearing, you should consult your legal staff before going forward with a benefit amount based on the earlier violations.

Another point to keep in mind is that as of the date the BEN analysis is performed, the violator might not yet be in compliance. Therefore, you must make an assumption regarding the date of eventual compliance. In discussions with the violator about the BEN calculation, you should be explicit about your compliance date assumption. You should then make clear to the violator that further delays in compliance will yield a higher economic benefit, and thus a higher penalty. Conversely, earlier compliance will yield a lower penalty. By conveying this information up front, you will give the violator added incentive to comply early, and will also avoid having to give the violator any "unpleasant surprises" should you have to increase the benefit component of the penalty.

C. OPTIONS

The standard values in BEN are updated annually to reflect changes in interest rates, tax law, and so forth. Although these values are updated, the assumptions upon which they are based remain the same. If the case you are analyzing is significantly different from that represented by the standard values, you may wish to customize some of the optional inputs. In particularly complicated cases, you might also want to consult the EPA helpline (888-ECON-SPT).

The options screen allows you to modify the discount/compound rate, cost indices for inflation, number of replacement cycles, useful life of capital equipment, future inflation rate, and the tax deductibility of one-time nondepreciable expenditures. You should customize these variables only if you have reliable information to substantiate the change.



1. Discount / Compound Rate

To compare the on-time and delayed compliance costs from different dates in a common measure, BEN adjusts both streams of costs (i.e., "cash flows") for inflation as of the date of initial noncompliance. After determining the initial economic benefit as of the noncompliance date (i.e., the difference between the on-time-case present value and the delay-case present value), BEN compounds this amount forward to the penalty payment date. To perform these present value calculations, BEN must employ a discount/compound rate that reflects the violator's "time value of money."

For a for-profit entity's discount/compound rate, BEN uses the weighted-average cost of capital (WACC) for a typical company, reflecting the cost of debt and equity capital weighted by the value of each financing source. A company must on average earn a rate of return necessary to repay its debt holders (e.g., banks, bondholders) and satisfy its equity owners (e.g., partners, stock holders). While companies often earn rates in excess of their WACC, companies that do not on average earn at least their WACC will not survive (i.e., their lenders will not receive their principal and/or interest payments, and their owners will be dissatisfied with their returns). The WACC represents the return a company can earn on monies not invested in pollution control, or, viewed alternatively, represents

the avoided costs of financing pollution control investments. Thus, a company should make its business decisions by discounting cash flows at its WACC, and BEN follows the internal analysis a company will normally perform.

For a not-for-profit discount/compound rate, BEN uses a typical municipality's cost of debt, based on interest rates for general obligation bonds.

The following page provides an example of the WACC calculation from the BEN detailed printouts. (The calculation for a municipality would be similar, but involve only debt financing.) BEN calculates the WACC in each year, then uses the average of the WACC over the period from the year of initial noncompliance through the year of penalty payment. Each year EPA appends the BEN model so that it contains another year of data for the WACC.

Some violators will argue for rates tailored to their industry, company, or specific division, or, for a not-for-profit entity, actual bond issues or debt ratings. In general, you should involve a financial analyst or contact the U.S. EPA enforcement economics toll-free helpline at 888-ECONSPT (326-6778) if the violator raises an issue about the cost of capital. Also, you should inform the violator that a case-specific cost of capital could result in a higher discount/compound rate, which will increase the economic benefit result.

If you customize the discount rate, be sure to enter it as a decimal. BEN will automatically convert it to a percentage.

2. Inflation Indices and Projected Inflation Rate

For actual historical inflation, BEN adjusts each cash flow from the date of the cost estimate by referencing a look-up table of cost index values.[4] The default cost index is the Plant Cost Index, from the magazine *Chemical Engineering*. This particular index may not be appropriate for every case. Thus BEN offers a pull-down menu for each compliance component listing other available cost indices. The inflation rate for each compliance cost category may be modified individually because the different cost categories may be affected by different inflationary trends. The table on the next page summarizes the optional indices. (Note that EPA modifies the BEN model each year to include new data from each index.) For projected future inflation, BEN extrapolates each cost index forward in time at a separate forecasted rate.[5]

In addition to the option of selecting an alternative to the PCI, BEN offers two other ways to modify its inflation adjustments.

First, BEN uses a separate projected future inflation rate for any additional recurring capital replacement cycles after the first one. You can override the standard value, which is based on the PCI projected rate for future inflation. If you modify the inflation rate, be sure to enter it as a decimal. BEN will automatically convert it to a percentage.

Second, on the "Specific Cost Estimates" screen, you can override BEN's inflation adjustments for the capital investment and one-time nondepreciable expenditure, and instead enter separate estimates for these compliance costs as of the noncompliance date, compliance date, and the initial recurring cycle start dates. This customized data entry can represent another alternative cost index, case-specific inflation assumptions, or entirely different actions for on-time and delayed compliance.

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[4] Unlike the earlier DOS version, BEN no longer applies an explicit inflation rate, although an annualized rate could be imputed from the model's data. For example, suppose a $200 cost estimate from 1991 must be adjusted for inflation to the same day in 1992. The 1991 cost index value is 100, whereas the 1992 index value is 103. The calculation the model performs is $200 * 103 / 100 = $206 (i.e., multiplying the original cost estimate by the ratio of the cost index values from the date on which the cost is actually incurred, and the date on which the estimate is made). The index change from 1991 to 1992 does represent an annual inflation rate of three percent (i.e., 103 / 100 = 1.03 - 1 = 0.03), but the model does not directly apply this rate. A calculation that uses the ratio of the index values is both more precise and more simple than one that calculates multiple annual inflation rates over different periods for historical costs.

[5] This is based upon a consensus forecast for the Consumer Price Index (CPI) and each individual index's historical relationship to the CPI. The rationale for the calibration of the other indices to the CPI is that the CPI has widely available forecasts for projected inflation, but the others do not.

INFLATION INDICES			
Abbreviation and Full Name		**Description**	**Typical Applications**
BCI	Building Cost Index	building costs; based on 1.128 tons Portland cement, 1,088 bd. ft. 2x4 lumber, 68.38 hrs. skilled labor	general construction costs, especially structures
BEN	current BEN model's constant inflation rate	average of PCI's last 10 years; i.e., a constant 1.8% increase each year	replication of results from current BEN model version
CCI	Construction Cost Index	construction costs; same as BCI, except 200 hrs. common labor	general construction projects, especially where labor costs are a high proportion of total costs
CPI	Consumer Price Index	representative consumer goods	compliance somehow involves consumer goods
ECIM	Employment Cost Index: Manufacturing	employment costs for the manufacturing industry	one-time nondepreciable expenditures or annual costs that comprise mainly labor
ECIW	Employment Cost Index: White Collar	employment costs for white collar labor	same as ECIM, except professional labor (e.g., permits)
PCI	Plant Cost Index	plant equipment costs	standard value

3. Capital Investment Replacement Cycles and Useful Life

You can specify the number of replacement cycles for the capital equipment, and the useful life of the equipment (i.e., the years between replacement cycles). A violator who delays installing pollution control equipment for, say, five years, benefits not only by delaying the initial expenditure five years, but also by postponing the second and potentially subsequent replacement cycles by the same five years.

The BEN model defaults to one replacement cycle, although you can specify as many as five. Because the present value of future costs decreases rapidly the further they occur from the present, additional replacement cycles after the first cycle typically have almost no significant impact upon the economic benefit result.

Not all capital investments need to be replaced at the end of their useful lives. For example, groundwater monitoring wells or other equipment used to close a RCRA site may not need to be replaced. By contrast, water and air pollution control equipment are typically replaced since this equipment is generally needed to support compliance for the foreseeable future. Most capital

investments will be replaced. In identifying equipment as a one-time purchase, you should be convinced that the equipment will not require future replacement. If this is indeed the case, set the number of replacement cycles to zero.

The useful life determines the number of years between replacement cycles. Equipment with a long useful life is replaced less frequently than equipment with a short useful life. Assuming the same investment cost per replacement cycle, the total present value of the costs of replacement for the longer-lived equipment would be lower (since each subsequent investment occurs later). Therefore, a longer useful life reduces the benefit of delaying compliance, holding all other inputs constant. Note that if useful life differs significantly from the 15-year standard value, you may need to consult an expert for off-line calculations to account for a different depreciation schedule.

If your capital investment reflects different pieces of equipment with significantly different replacement cycles and/or useful lives, you need to create separate BEN runs for the differing equipment. You can add together the results from the two calculations to determine the total economic benefit.

4. Tax Deductibility of One-Time Nondepreciable Expenditure

Most one-time nondepreciable expenditures are tax-deductible; with the primary exception being purchases of land. Land is an asset and, therefore, cannot be deducted as an expense from taxable income. BEN assumes that the expenditure is tax-deductible unless you uncheck the box.

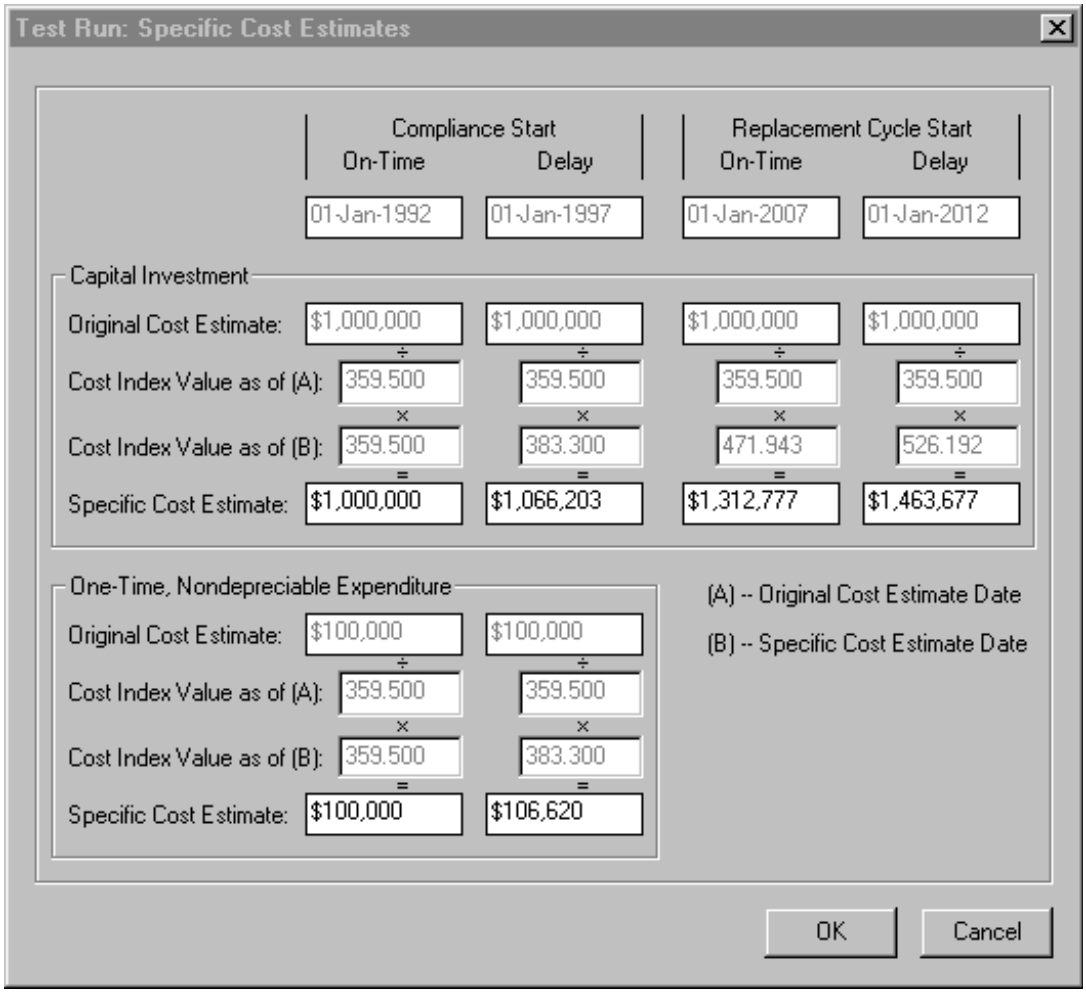
D. SPECIFIC COST ESTIMATES

The specific cost estimate screen allows you to view BEN's inflation adjustments, which calculate specific cost estimates for certain dates, extrapolating from the original single cost estimate (which you enter on the earlier screen for compliance components data). This screen also allows you to override BEN's calculations for the specific cost estimates. You reach the specific cost estimates screen by pressing **[Specific Cost Estimates]** at the bottom of the options screen.

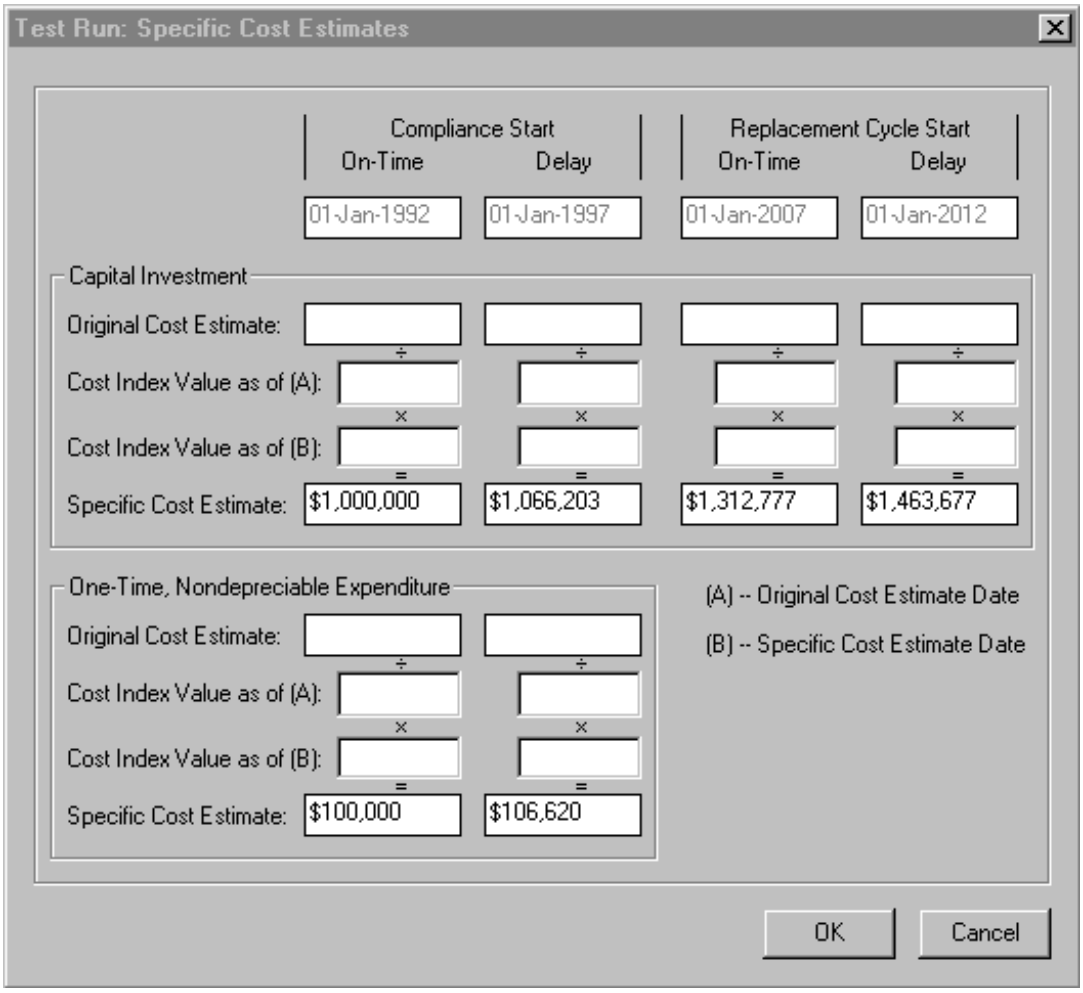
All data except for the specific cost estimates are "grayed out", since BEN allows to you override only the final estimates, not the intermediate calculations. Changing your inputs on prior screens, however, will have an impact on the "grayed-out" data, unless you click **[OK]** on this screen, which will lock in your inputs on prior screens. (BEN takes this action because otherwise it would not know whether you intended subsequent changes to prior screens to affect the customized data you have entered on this screen.) Clicking **[OK]** on this screen will also visually erase all of the other data when you return to this screen in the future. (BEN takes this action because it does not know how much of the other data you incorporated into your customized specific cost estimates.)

BEN displays four separate columns of data, corresponding to the start dates of the on-time compliance scenario (i.e., the noncompliance date), the delay compliance scenario (i.e., the compliance date), the on-time replacement cycle (i.e., the noncompliance date plus the useful life of capital equipment), and the delay replacement cycle (i.e., the compliance date plus the useful life). The first row simply provides the date for each scenario, as calculated above. The next rows are divided into two groupings: the first for capital investments, and the second for one-time nondepreciable expenditures.

Each grouping starts with a row for the single cost estimate you originally entered on the basic run input screen. The second row then displays the value of the selected cost index (the Plant Cost Index is the default) as of the cost estimate date, and the third row displays the value for the same cost index as the specific cost estimate date. The final row (as the operator signs between the rows indicate) is equal to the first row divided by the second row, multiplied by the third row.



If you click **[OK]** on the specific cost estimate screen, exit it and then later return, all of the intermediate calculations will be blank, and only the final specific cost estimates will appear:

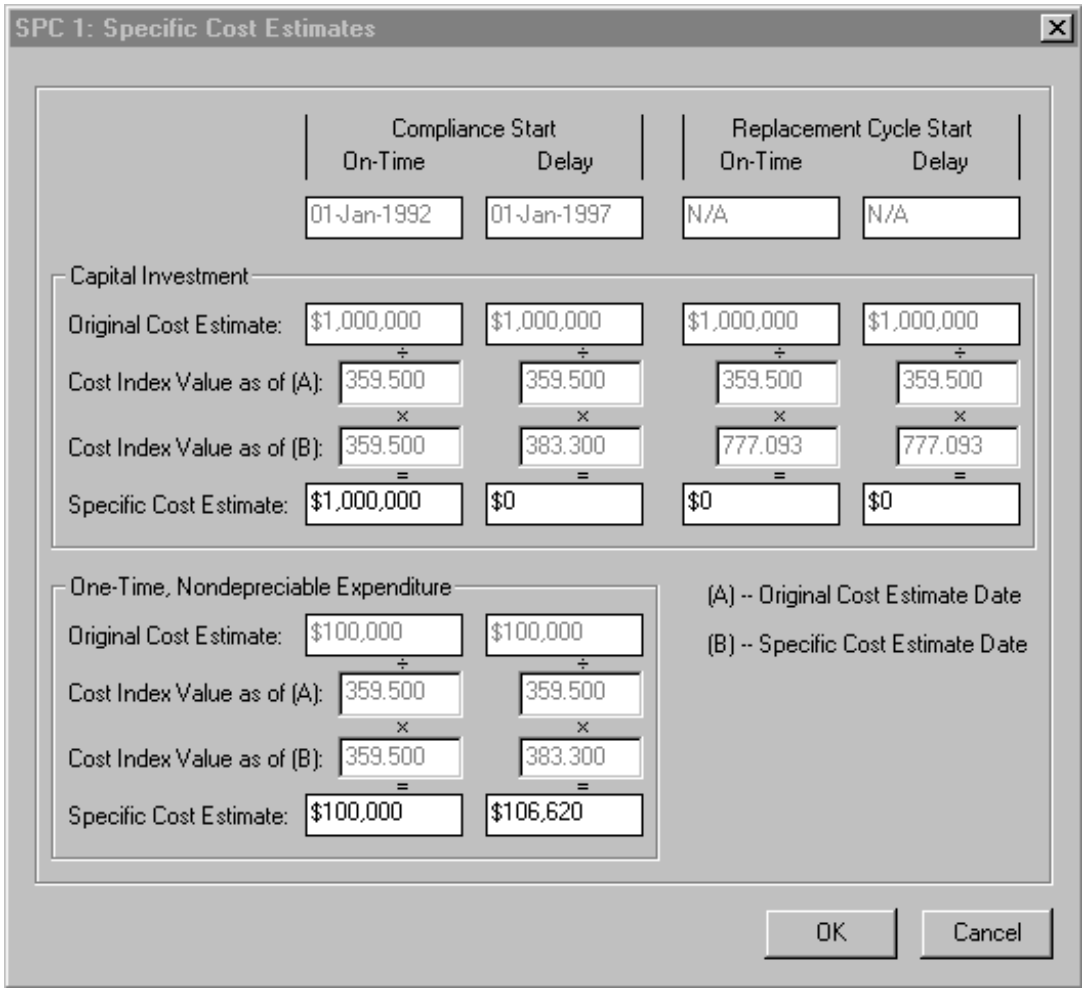


Reasons for modifying BEN's calculations can include any of the following three scenarios, but be prepared to document your actions and rationale.

1. ***The Compliance Costs Are Avoided Entirely, Not Merely Delayed.***

Change the specific cost estimate in the second column (i.e., delay scenario compliance start) for the appropriate expenditure grouping to zero. For a capital investment, first go back to the **[Options]** screen and set the number of replacement cycles to zero.[6]

In the example below, the violator avoided a capital investment completely, never having to incur the cost. To reflect this, the user set the number of replacement cycles to zero on the options screen, and then changed the specific cost estimate for the delay compliance start to zero.

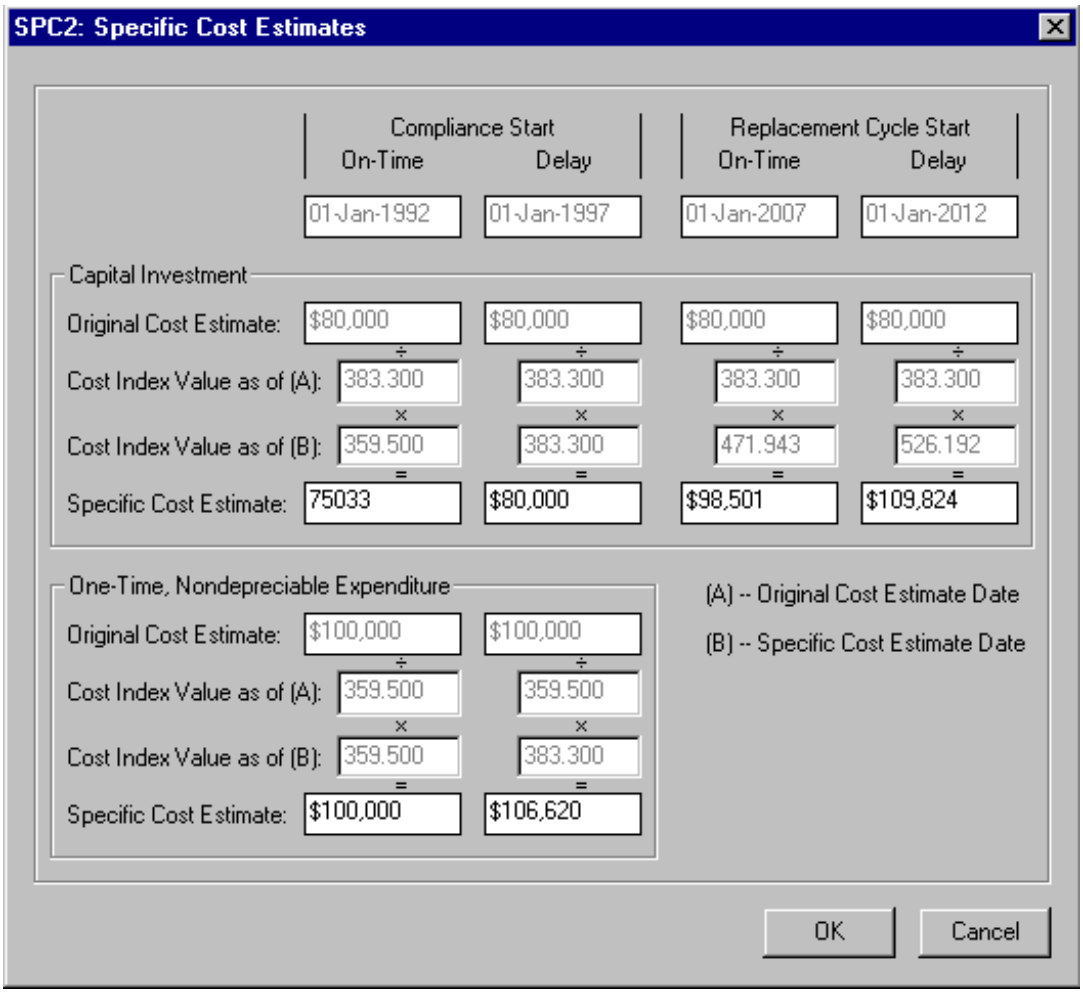


[6] If the violator has avoided not only the initial capital investment but also a replacement cycle (i.e., the useful life of the capital equipment is shorter than the period of noncompliance), then keep the default assumption of one replacement cycle, but also change the specific cost estimate in the fourth column (i.e., delay replacement cycle start) to zero.

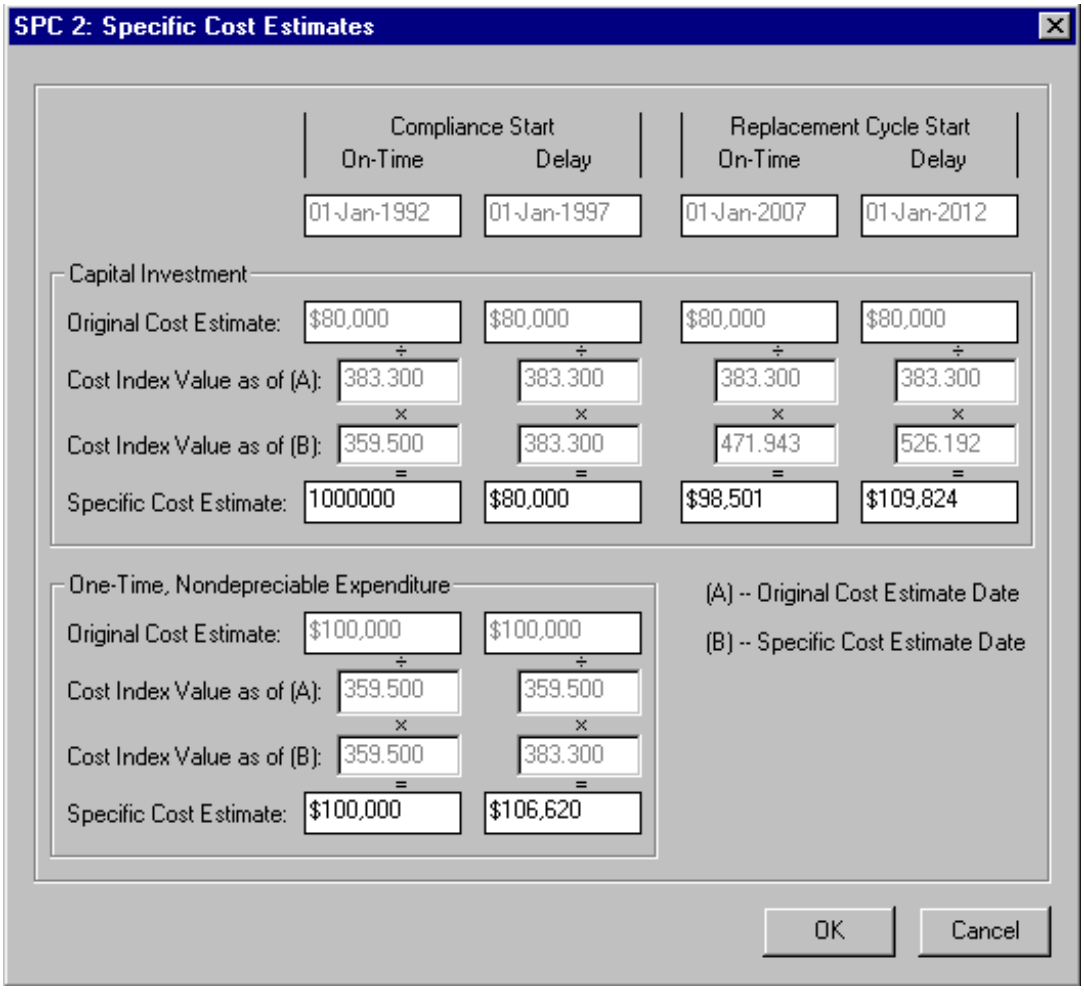
2. ***You Have Separate Cost Estimates for Both the Noncompliance and Compliance Date.***

This could reflect several scenarios: the violator obtained a cost estimate at the noncompliance date, even though it did not comply until later; technological change between the noncompliance and compliance dates implies that different compliance measures were available at the two dates; or, regulatory change over time mandated different compliance measures at the noncompliance vs. compliance dates. Under such scenarios, use the most recent data for the original capital cost estimate so that it reflects the delay compliance scenario (ensuring that any future capital equipment replacement cycles are calculated correctly). Then, override the specific cost estimate in the first column (i.e., on-time scenario compliance start) with the correct estimate.

In the example below, the violator obtained a cost estimate for required capital investments of $100,000 at the date of noncompliance (January 1, 1992), but because of technological change it only had to spend $80,000 when it came into compliance on January 1, 1997. The user entered the $80,000 estimate (with an estimate date of January 1, 1997) as the capital investment cost on the initial input screen. The specific cost estimate screen then appears as:



However, had the violator actually complied on time it would have faced a capital investment of $100,000 (the estimate it received in 1992), not $75,033 (the specific cost estimate as calculated from the 1997 estimate). To reflect this, the user changed the on-time compliance specific cost estimate to $100,000.



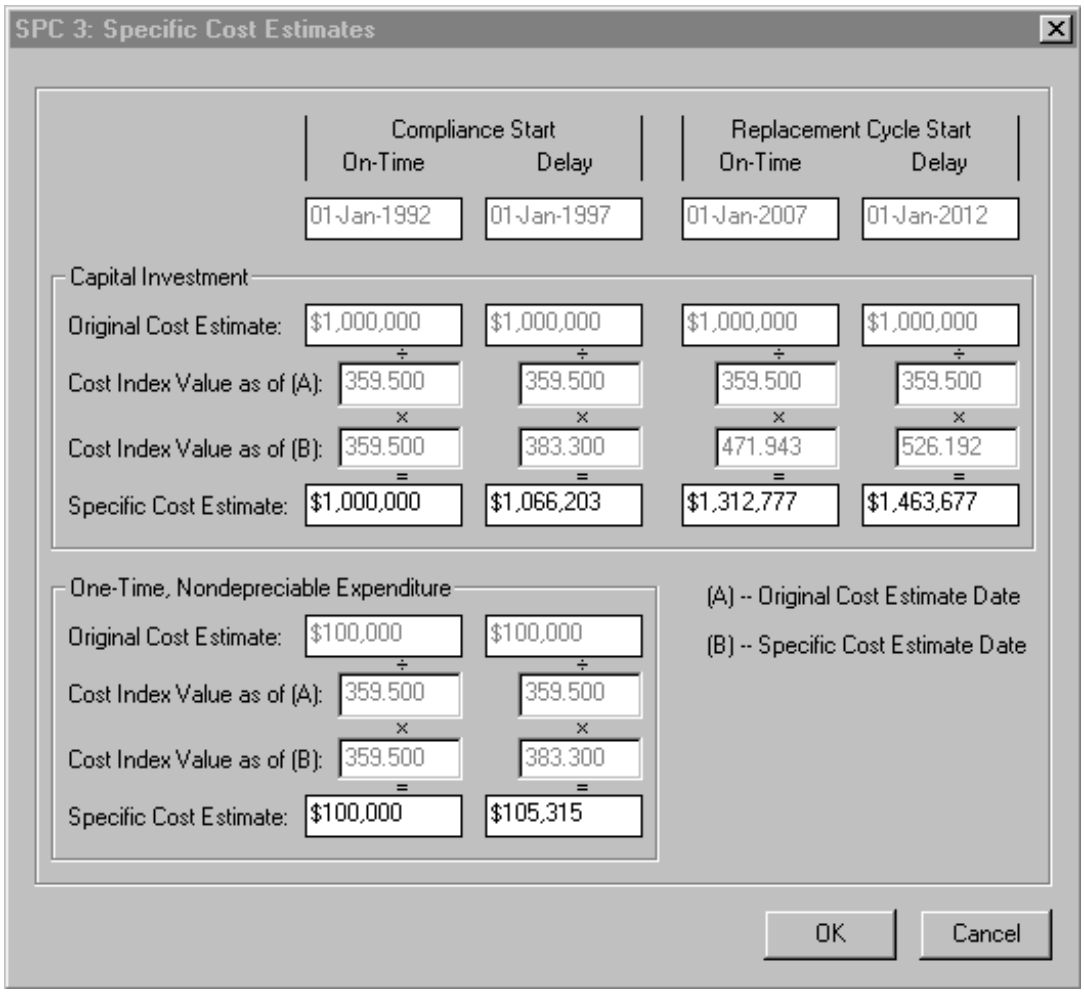
3. ***You Have Inflation Data that Is More Appropriate than BEN's.***

Although BEN offers many other alternative cost indices in addition to its default Plant Cost Index, occasionally some other inflation adjustment may be necessary. If so, override whichever specific cost estimates you believe are inaccurate. (If you are using some other index, you might want to create a spreadsheet that mimics the BEN screen, substituting your index's values for the ones on the screen.)

In the following example, the one-time nondepreciable expenditure consists mostly of chemicals. A subset of the Producer Price Index for chemicals will give a more precise inflation adjustment than the various indices BEN offers. You can use this chemical index to adjust the original cost estimate for inflation as shown in the table below:

Specific Cost Estimate Transportation Equipment Index		
	On-Time (1/1/1992)	Delay (1/1/1997)
Original Cost Estimate	100,000	100,000
	÷	÷
Cost Index Value	111.0	111.0
as of original estimate date	x	x
Cost Index Value	111.0	116.9
as of specific cost estimate date	=	=
Specific Cost Estimate	1,000,000	105,315

Once you have calculated the appropriate specific cost estimates, you can incorporate them into the BEN calculation by overriding the values on the specific cost estimate screen, as shown on the next page.


SPC 3: Specific Cost Estimates
Compliance Start
On-Time
Delay
Replacement Cycle Start
On-Time
Delay
01-Jan-1992
01-Jan-1997
01-Jan-2007
01-Jan-2012
Capital Investment
Original Cost Estimate:
$1,000,000
$1,000,000
$1,000,000
$1,000,000
÷
Cost Index Value as of (A):
359.500
359.500
359.500
359.500
×
Cost Index Value as of (B):
359.500
383.300
471.943
526.192
=
Specific Cost Estimate:
$1,000,000
$1,066,203
$1,312,777
$1,463,677
One-Time, Nondepreciable Expenditure
Original Cost Estimate:
$100,000
$100,000
÷
Cost Index Value as of (A):
359.500
359.500
×
Cost Index Value as of (B):
359.500
383.300
=
Specific Cost Estimate:
$100,000
$105,315
(A) -- Original Cost Estimate Date
(B) -- Specific Cost Estimate Date
OK
Cancel